3.0 Source Management and HFBR Modifications

Background

BNL is identifying potential sources and making design changes to prevent future contamination.

Source management involves the identification of potential sources of tritium from within the HFBR and developing modifications to prevent further releases. The first step was to identify all sources of tritium that could be released from the HFBR to the groundwater. Once these potential sources were identified, BNL was able to begin developing modern designs and modifications to these systems to prevent any releases. The final step of the process is to capture these modifications in the safety analysis report (SAR) revision and the facility operational information to support a decision on the future of the HFBR.

In its February 1997 report, EH identified expedited planning, preparation, and decisions related to tritium plume source resolution as an opportunity for improvement. The opportunities for improvement identified potential actions for DOE and BNL to consider in areas such as spent fuel pool leak detection systems, reduction of spent fuel inventory, source identification and monitoring, and inspections of reactor building seals and floor penetrations.

HFBR Spent Fuel Pool

Results

BNL has applied appropriate resources and completed many actions to identify and mitigate potential sources of tritium.

Since the tritium contamination was identified in December 1996, BNL has completed many initial actions and appropriately addressed many of the opportunities for improvement identified in the February 1997 Office of Oversight interim evaluation report. These actions included preliminary engineering designs, removal of spent fuel from the reactor and spent fuel pool, engineering evaluations, and tests to determine potential sources of leakage. Appropriate project resources are being applied to ensure source identification and correction at the HFBR.

BNL issued the "High Flux Beam Reactor Tritium Source Identification" report on July 31, 1997. This report reviews all activities conducted to date by BNL to identify the source of tritium contributing to the plume emanating from the HFBR building. Source identification activities consisted of evaluating sources of tritium that have the potential to release tritium into the environment. Leak tests were conducted where appropriate to determine the integrity of each of the potential sources containing tritium. Table 1 summarizes actions taken by BNL and the results.

Table 1. High Flux Beam Reactor Tritium Source Identification, Evaluation, and Resolution Conducted by Brookhaven National Laboratory

Potential Source	Description	Results	Actions/Design Improvements to Prevent Possible Releases
Primary coolant purification system piping	Embedded piping in equipment level floor (ELF) from reactor to the pipe trenches	Leak tested at 425 psig during construction. Engineering evaluation.	Flexible stainless steel piping will be inserted into the existing embedded piping and welded. The installation will meet Suffolk County Article 12 requirements. This design provides double wall protection to prevent releases.
Primary coolant purification system trenches	Trenches containing filters and resin beds located northeast of the spent fuel pool	Visual inspection and air leak test. No air shown to be infiltrating at 0.7 inch negative pressure in the reactor building .	Trenches are continuously monitored during operation and do not normally contain tritium.
DA drain, D2O transfer system and FA101 pit	Embedded piping in ELF to drain primary coolant to FA101 tank	Visual inspection and air leak test. No air shown to be infiltrating FA101 pit at 0.7 inch negative pressure in building. Sump filled with water and no leakage observed.	Embedded piping will be rerouted above floor.
CD floor drains	Floor drains in A, B, and shutdown cells routed in ELF FA101 sump	Engineering evaluation. Leak tested at 50 psig during construction.	Additional leak testing planned to demonstrate compliance with Article 12 requirements.
Spent fuel pool water purification system piping	Piping leading to and from the spent fuel pool to the water cleanup system	Supply and return lines isolated and leak tested at 50 psig. No loss in system pressure observed.	Embedded piping to be drained, capped, and abandoned. New piping to be rerouted above the concrete.
D-Waste floor drain piping and sump	Drainage system in ELF for light water process sytems	Engineering evaluation. Leak tested at 50 psig during construction.	Eight different modifications to the system are required to reroute active (wet) drains. System to be reclassified as a dry system when modifications are completed. Drain piping in the floor will remain for emergency use.
Spent fuel pool	68,000 gallon storage pool located on the east side of the reactor core	Two leak tests confirm leakage at a rate of 6 to 9 gallons per day. Visual inspection showed no apparent leakage locations. Horizontal well sampling and analysis inconclusive to date.	Conceptual design completed which indicates that a double walled stainless steel insert with leak detection is the best method for eliminating further releases from the spent fuel pool.
Equipment level floor seams and other perforations	Drains, penetrations, and seams in A, B, and shutdown cell. Also CD cleanout drain near B cell	Leak testing apparatus developed for static water leak tests. Leakage occurred at some locations in A, B, and shutdown cell. CD cleanout drain grouting accepted water at a rate of 1 liter in 9 minutes.	Floor seams will be repaired utilizing a foam impregnated waterproof polymer sealed with a urethane epoxy sealer. Floor seams and penetrations will be entered into the routine surveillance program to ensure integrity.
Sanitary system piping	Embedded piping runs around circumference of equipment level floor	Historical tritium concentrations managed in sanitary system have been less than the highest concentrations seen in the plume. Waste streams containing tritium are no longer sent to sanitary sewer system.	Rerouting of waste streams minimizes the tritium in the sanitary water.
Secondary cooling water systems	Primary coolant routed to heat exchanger for heat removal	Secondary coolant continuously monitored and no leakage has been observed.	Continuous monitoring is required for operation.

Based on two separate leak-rate tests, the BNL report concluded that the spent fuel pool is the most likely source for the tritium contamination in the ground water. Concentrations of tritium in the spent fuel pool water are consistent with the concentrations observed in the plume emanating from the HFBR building.

In April 1997, two horizontal wells were installed near the spent fuel pool underneath the reactor building. These wells were placed in the water table to the north and south of spent fuel pool (groundwater flows generally from north to south) in an attempt to confirm the spent fuel pool as the source of the tritium. The results from these wells has been inconclusive so far because of the wells' location in the aquifer (i.e., seasonal variation in the water table level has made it difficult to obtain representative samples). However, BNL expects to obtain more representative samples in the next few months as the water table levels undergo their normal seasonal changes.

BNL is well on the way to having all spent fuel shipped off site, which will allow draining of the spent fuel pool.

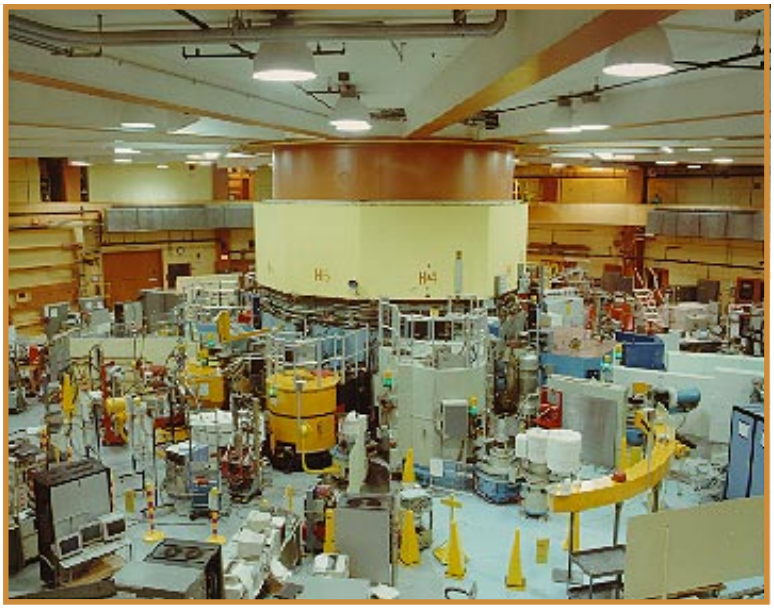
BNL has completed three of four fuel shipments. The fourth shipment is in progress and is expected to be complete by mid-September. This action will complete the removal of spent fuel from the spent fuel pool, which is a prerequisite to pumping out the pool and eliminating the most likely tritium source. The accelerated fuel shipment schedule was accomplished in coordination with the NRC. Specifically, NRC reviewed and approved an amendment to the shipping container license; approval of this amendment was a prerequisite for two (the third and fourth) of the four shipments.

A decontamination and dewatering plan for the spent fuel pool was prepared. It is being revised by the project team to add information and improve the approach to pumping out the fuel pool. The plan outlines the steps necessary to remove the activated components and contaminated equipment from the pool, dewater the pool, and decontaminate it. The plan relies on the installation of two new 20,000 gallon tanks combined with an existing 25,000 gallon tank in Building 811 to accept the spent fuel pool water. The existing tank is currently full of contaminated water; it must be emptied to support draining the spent fuel pool. BNL is starting up an evaporator to assist in processing the current inventory of contaminated water. The spent fuel pool is scheduled to be pumped out in November 1997.

BNL conducted an engineering evaluation to identify suitable material to replace the sealant between the building floor joints and penetrations. The existing sealant has exceeded its design life and will be removed, and the affected areas will be cleaned. An open-cell, foam-impregnated, waterproof polymer will be used to seal the seams. A second coating of urethane epoxy sealer will be applied over the polymer to provide another leak-tight seal. Repairs are scheduled to begin in October 1997. A procedure for inspecting the seals is being developed and will be incorporated into the surveillance and maintenance programs at HFBR.

In conjunction with source identification and engineering analysis, BNL has prepared the HFBR Transition Plan, which outlines the necessary steps to modify the reactor to support a Secretarial decision on the future of the HFBR. The plan also outlines the key elements necessary to support the future of the HFBR once all of the modifications are complete. Implementation of this plan is contingent upon the Secretary's decision regarding the future of the HFBR.

High Flux Beam Reactor Experimental Floor



The HFBR safety analysis report is being revised to meet current standards.

One issue related to the future of the HFBR involves revising the HFBR SAR to meet current standards and requirements. CH and BNL consider modifying the SAR to be a necessary component to support the future of the HFBR. Work on the SAR revision began on April 1, 1997, using the SAR implementation plan approved by DOE in December 1996 as general guidance. A draft SAR is scheduled for submittal to DOE in December 1998. The SAR modification work is performed by in-house Reactor Division staff who are knowledgeable about the operating history, existing design, and current requirements. The revision is being performed as an integrated project, with a dedicated project manager and specific tasks. Criteria requirements include reformatting, updating, modifications, and comparison with 5480.30, "Nuclear Reactor Safety Design Criteria."

NE's commitment to and expectations for the safety analysis report revision have not been clearly communicated.

Although CH and BNL understand the scope and necessity of the SAR revision, there are some concerns regarding the communication and understanding of NE's commitment at the site level. NE has recently reaffirmed to EH its commitment to revise the SAR on schedule. However, clarification is needed at each organizational level to establish consistency in expectations for transition, funding, and the review and approval process.

The DOE orders pertaining to SARs and reactor design require a rigorous, detailed, and systematic approach to hazard and accident analyses that includes worker safety. They also require technical descriptions and evaluations of the adequacy of safety systems and components included as design features. These orders further require existing reactors, such as HFBR, to evaluate the adequacy of their safety basis against the spent fuel pool performance and design criteria requirements. NE needs to ensure that commitments to address these requirements are clearly communicated. The Office of Oversight will continue followup reviews of the SAR revision process.

Assessment of Source Management and HFBR Modifications

Although continued attention is needed, DOE and BNL have made significant progress in eliminating sources of tritium contamination.

Significant progress has been made in evaluating potential HFBR tritium sources and developing preliminary designs to prevent further releases. These designs will enable HFBR to meet regulatory requirements to support HFBR's future. The Project Manager for Source Management is proactively addressing issues and developing solutions for source management within the HFBR. The removal of spent fuel from the spent fuel pool has accelerated the schedule for eliminating the source of tritium in the groundwater. Continuing management vigilance and resourcefulness will be essential to assure that challenges, such as funding and resource reductions or discovery of additional groundwater contamination, do not adversely impact essential activities such as fuel pool pumping and liner installation, HFBR modifications, or the SAR revision.